Small Business Innovation Research/Small Business Tech Transfer

# Refractory Additively Manufactured Affordable Launch Vehicle RCS, Phase I



Completed Technology Project (2018 - 2019)

#### **Project Introduction**

Due to the rapid maturity of small satellite technologies to meet near term commercial, science and military space applications there is a driving need for development of increased affordable space launch system capability. To address this need, Valley Tech Systems and the University of Texas El Paso (UTEP) is proposing evolving our innovative Affordable Launch Vehicle Reaction Control System (ALV-RCS) through applying advanced refractory additive manufacturing (RAM) production technologies to titanium-zirconiummolybdenum (TZM) alloy with a goal of reducing the ALV RCS cost by 25% and weight by 20% which will support the progressive development of affordable small spacecraft launch systems. This new refractory additive manufacturing technology will replace older, heavier and less preforming Cold Gas ACS products providing NASA and future launch system providers with increased capability with improved affordability. Our solid RCS is applicable to both a future commercial booster flyout Attitude Control System (ACS) applications and future Post Boost Propulsion System (PBPS) payload deltav and ACS providing increased satellite orbital insertion accuracies. The Phase II program will mature the new solid RCS technology to a TRL-6 ready for insertion into follow-on commercial launch system integration and flight testing. The result is a new affordable and higher performing solid RCS that fills an identified critical technical gap for future affordable access to space.

#### **Anticipated Benefits**

VTS has identified potential insertion of this technology for a reaction control system on future commercial low-cost launch vehicles.

Other near-term applications that can leverage this innovation:

Hypersonic Inflatable Aerodynamic Decelerator (HIAD)

HIAD for United Launch Alliance (HULA)

Towed Glider AirLaunch System (TGALS)

Mars Ascent Vehicle Reaction Control System (MAV RCS)

Lunar/Mars Landers

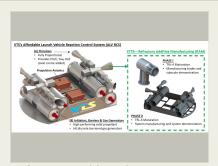
Large booster systems

Low Earth orbit smallsats

Deep-space smallsats

Non-propulsive gas generators

The new refractory additive manufacturing technology can be applied to applications such as:



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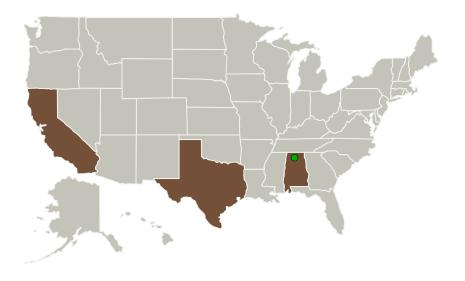
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Next generation kinetic energy Kill Vehicles for the Missile Defense Agency and Navy

Future USAF Ground Based Strategic Deterrent (GBSD) Post Boost Propulsion and booster Roll Control System applications

Hypersonic steering for U.S. Army and DARPA

#### **Primary U.S. Work Locations and Key Partners**



Organizations Performing Work	Role	Туре	Location
Valley Tech Systems, Inc.	Lead Organization	Industry	Folsom, California
Marshall Space     Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
The University of Texas at El Paso	Supporting Organization	Academia Hispanic Serving Institutions (HSI)	El Paso, Texas

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

#### **Lead Organization:**

Valley Tech Systems, Inc.

#### **Responsible Program:**

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## **Project Management**

#### **Program Director:**

Jason L Kessler

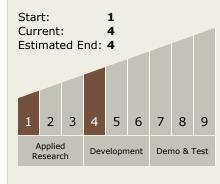
#### **Program Manager:**

Carlos Torrez

#### **Principal Investigator:**

Christopher Smith

# Technology Maturity (TRL)





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Primary U.S. Work Locations		
Alabama	California	
Texas		

### **Project Transitions**

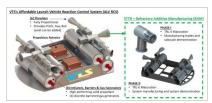
July 2018: Project Start

August 2019: Closed out

#### **Closeout Documentation:**

• Final Summary Chart(https://techport.nasa.gov/file/137894)

### **Images**



#### **Briefing Chart Image**

Refractory Additively Manufactured Affordable Launch Vehicle RCS, Phase I (https://techport.nasa.gov/imag e/131463)



### **Final Summary Chart Image**

Refractory Additively Manufactured Affordable Launch Vehicle RCS, Phase I (https://techport.nasa.gov/imag e/133256)

### **Technology Areas**

#### **Primary:**

- - □ TX01.1.1 Integrated Systems and Ancillary Technologies

## Target Destination Earth

